MODIS DATA STUDY
TEAM PRESENTATION

March 23, 1990

AGENDA

1. Volcanology Expectations for MODIS (Real-Time) (McKay)
2. Processing Scenario for MODIS/Volcanology Investigations (Ardanuy)
3. Simulation of Global Land Coverage by MODIS-T: Progress Report III (Gregg, Riggs)
4. Level-3 Processing Sizing Estimates (Schols)
5. Metadata and Browse Data: Definitions from the IWG (McKay)
6. EOS Science Advisory Panel for EOSDIS (Wolford)
7. Impressions Derived From the EOS Facility Instruments Panel Meeting (Ardanuy)

PETE MAUGINIS-MARK
(808) 948-6490
(P.MAUGINIS.MARK/OMNET)
FAX (808) 949-2176

VOLCANOLOGY EXPECTATIONS FOR MODIS (REAL-TIME)

The Volcanology IDS Team looks to MODIS-N to provide crucial, continuous monitoring capability in order to detect new volcanic eruptions and sites not currently under observation by EOS (on a timescale of days).

We plan to use MODIS-N data in two modes to detect eruptions:

1. By thermal anomalies, detected at wavelengths between approximately 1.6 and 12.0 μm. High temperatures (approximately 500 to 1,100°C) can be observed at approximately 1.6 to 2.4 μm without sensor saturation (particularly since the size of the hot spot is <1 km). Cool anomalies (approximately 100 to 500°C) can be observed between 3.5 and 12.0 μm.

2. By (potentially) detection of SO_2 anomalies. We are exploring ideas to use absorption features at approximately 4 μm or 8 μm to observe atmospheric loading of the troposphere/stratosphere of several tens of kilometers SO_2 per day. Currently, we know that SO_2 can be detected at UV wavelengths (0.300 to 0.354 μm) from TOMS data, but do not believe MODIS has this wavelength range.

OPERATING MODE:

We want to use MODIS-N to detect/verify an erupttion and enable us to request EOSDIS to turn on the high spatial resolution instruments (HIRIS, SAR, and ITIR) at the first available opportunity. From the time that the eruption is observed by MODIS until new high resolution acquisitions are obtained should be about 48 hours, since eruptions are transient phenomena. Thus, the MODIS data that we will search at EOSDIS with our supplied algorithms should be priority processed.

We envisage the following search method:

Our algorithm should continuously search the following priority-processed MODIS data:

1. A visible band (approximately 0.6 μm)

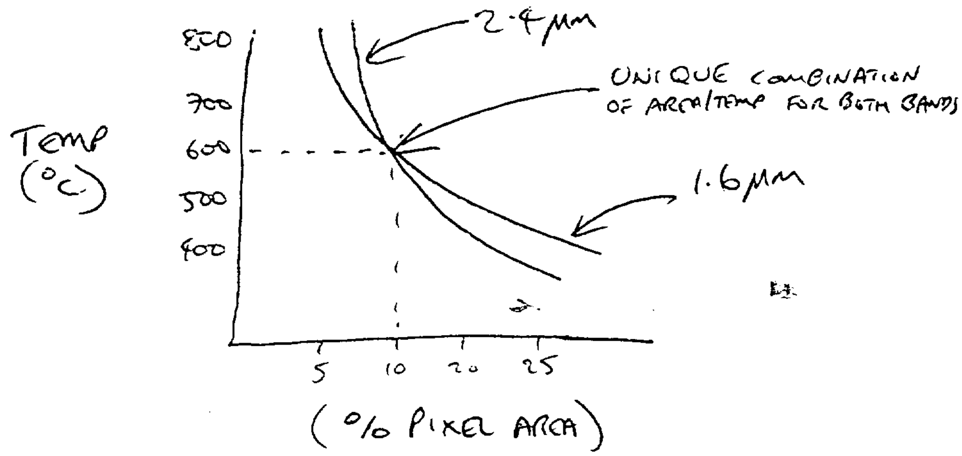
2. Two near-IR bands (approximately 1.6 and 2.2 μm) for temperatures

3. Two thermal IR bands (approximately 4 μm and 8 μm) for SO_2

4. One other band TBD

Why more than 1 MODIS band for temperatures?

We need at least two thermal bands between 1.6 and 2.4 μm in order to uniquely resolve the temperature of volcanic phenomena at the subpixel scale. One band would only allow estimation of a suite of temperature/area combinations (i.e., it could be a very hot small area, or a warm large area). Two bands let us construct below diagram.



While we can, in theory, perform this fit with two bands, due to the temperature differences between lava flows (>500°C) and eruption plumes (<50°C), we will need multiple SWIR/TIR combinations for the rigorous retrospective studies.

DATA FLOW

We do not expect many unexpected eruptions to trigger alarms--perhaps 1 per week is likely. However, once an alarmed pixel (either a thermal anomaly or an SO_2 spike) is found, we will require EOSDIS to send us a 512 x 512 pixel, 6-band image either over SPAN or the phone/fibre optic link that exists at that time. Transmission of this data set should only require a few minutes.

If no alarm is detected by MODIS, these "quick-look" data are not required. We plan to use MODIS-N data (all bands) for certain retrospective studies, but we will obtain these Level-1 or -2 data from EOSDIS once they are available a few weeks after acquisition.

For targets where MODIS does detect an eruption, we will use the 512 x 512 image to confirm an eruption, or reject as a forest fire, factory plume, etc. We will make this judgement based upon geographic location (we know where most volcanoes are) and on the shape of the anomaly. A running-list of alarm locations will be kept in order to avoid a new alarm being generated per orbit, or alarms from known eruptions.

NIGHTTIME OPERATIONS

Due to the very high temperatures of lava flows (>500°C), it is important to continue monitoring for new eruptions both during the day and at night.

We ark that MODIS-N data be collected at night at wavelengths as short as 1.6 μm, because this will enable us to infer lava temperatures.

Nighttime data between 1.6 μm to 12.0 μm will be needed both for eruption alarms and for retrospective quantitative measurements of flow temperatures.

"POSITIVE RESPONSE ERUPTION!"

Lava Flows (on the ground) (hot spot) (>500°C)

Turn on: SAR, ITIR, HIRIS, MODIS-T, local mode MISR

Eruption Columns (airborne) (SO_2 + <200°C anomaly)

Turn on: ITIR, HIRIS, local mode MISR, GLRS altimeter, MODIS-T

Decision also based on visual inspection of 512 x 512 x 6-band quick-look MODIS-N image.

ADDITIONAL ALARMS

In addition to MODIS-N-generated alarms (eruption detection) there are two other methods by which requests for high spatial resolution instruments may be turned on:

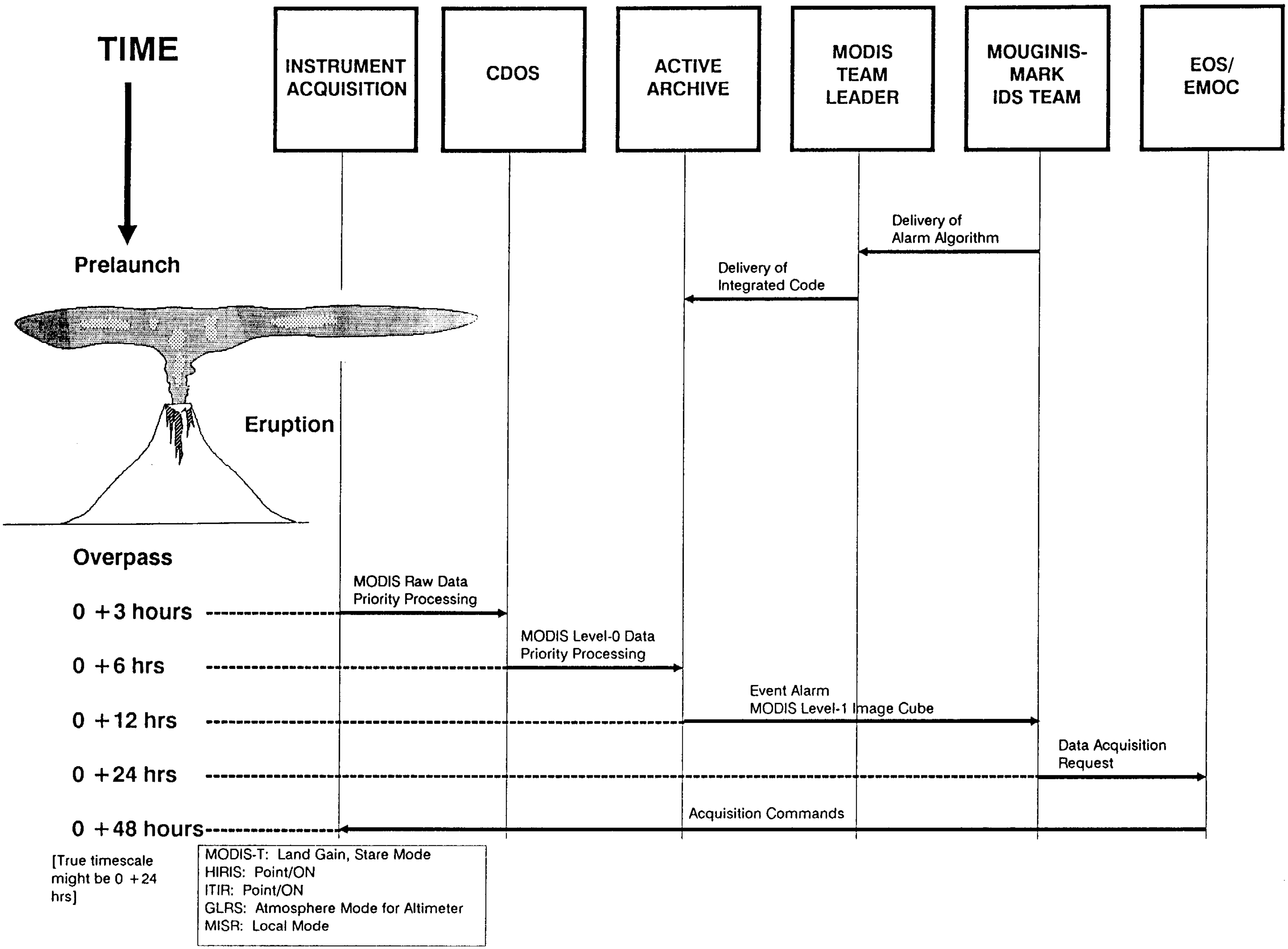
1. Via the Smithsonian's Scientific Environmental Alert Network (SEAN), which is a worldwide community of volcanologists who phone in information that a volcano is erupting.

2. Via observations from other orbital platforms:

   a. Astronaut observations from the Shuttle/Space Station (Hawaii is working with JSC to develop communications with EOSDIS via SEAN/HAWAII)

   b. Weather satellites (GOES or the TOMS instruments). TOMS measures SO_2 (Sends direct to SEAN at present time).

PROCESSING SCENARIO FOR MODIS/VOLCANOLOGY INVESTIGATIONS



Simulation of Global Land Coverage by MODIS-T: Progress Report III

We are continuing our work simulating MODIS-T orbits to identify potential land coverage. For review, the question addressed here is: what will be the land coverage if for any scan containing ocean the sensor is ocean mode (gain). Eos orbital and MODIS sensor characteristics relevant to this simulation are provided in Table 1.

For this report we have simulated global land coverage for a "CZCS tilt strategy", i.e., 0 tilt for sub-satellite ground points > $\pm$ 32.5° from the solar declination sub-solar point, -20° tilt (aft) for a sub-satellite point southward of the sub-solar point to -32.5°, and +20° tilt (fore) northward to +32.5° of the sub-solar point. This tilt strategy was suggested by Wayne Esaias as a possible reasonable simulation of MODIS.

Examination of the land coverage by this tilt strategy requires three simulations to be representative: one for the equinox, and one each for the Northern Hemisphere summer and winter solstices. The results for these three scenarios are plotted in Figs. 1-3, as land coverage composites for 16 days (the orbital repeat time for Eos).

Land coverage was determined by comparing the areas viewed by individual pixels with the Elaine Matthews Global Vegetation Data Set (GVDS) from the National Climate Data System (NCDS), which is a global map of vegetation types on a 1° by 1° latitude/longitude grid. Plotted on the figures are 1° x 1° grid boxes of land coverage. This coverage is derived from the actual simulated scan coverage, but the horizontal lines do not depict the scan pattern, rather the Earth coverage at GVDS spatial resolution.

One may immediately note the large land coverage for the composite figure (Fig. 1). However, it is clear that some land areas of the Earth are never covered if ocean coverage is to be maximized in dual mode. Some notable areas are Spain, Scandinavia, the southern tips of South America and Africa, Central America, and the southeast Asian archipelago. Note also the gap in coverage at the Equator; this is due to the tilt strategy, whereby the tilt was changed from -20° to +20° at the Equator for this equinox simulation. This coverage gap moves to the solstices for the summer and winter solstice simulations (Figs. 2 and 3). This coverage gap will also apply to ocean coverage, suggesting the need for MODIS-N imagery for these regions.

The composites reveal substantial land coverage, even under ocean coverage maximization, including many coastal features. It should be noted, however, that under the stipulations of the simulation, that if any ocean lies under the scan the entire scan is in ocean mode, that coastal coverage is entirely due to scan edges.

Coverages for each day in the 16-day simulation are also provided as Figs. 4-20 to allow observation of daily coverages and overlaps. These simulations were performed for the Equinox case.

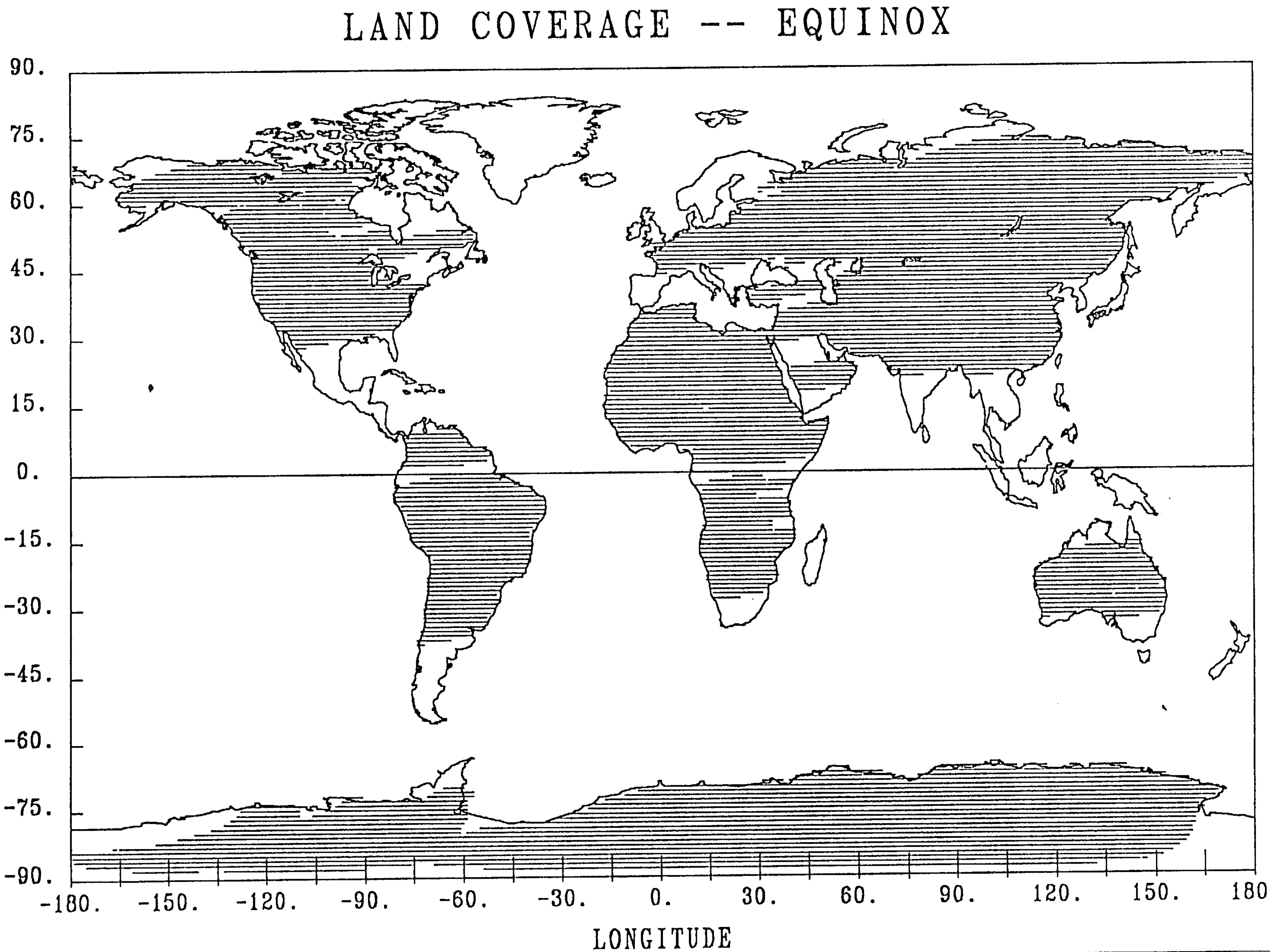
Table 1. EOS orbital simulation parameters and MODIS-T instrument characteristics.

<u>EOS Orbital Parameters</u>

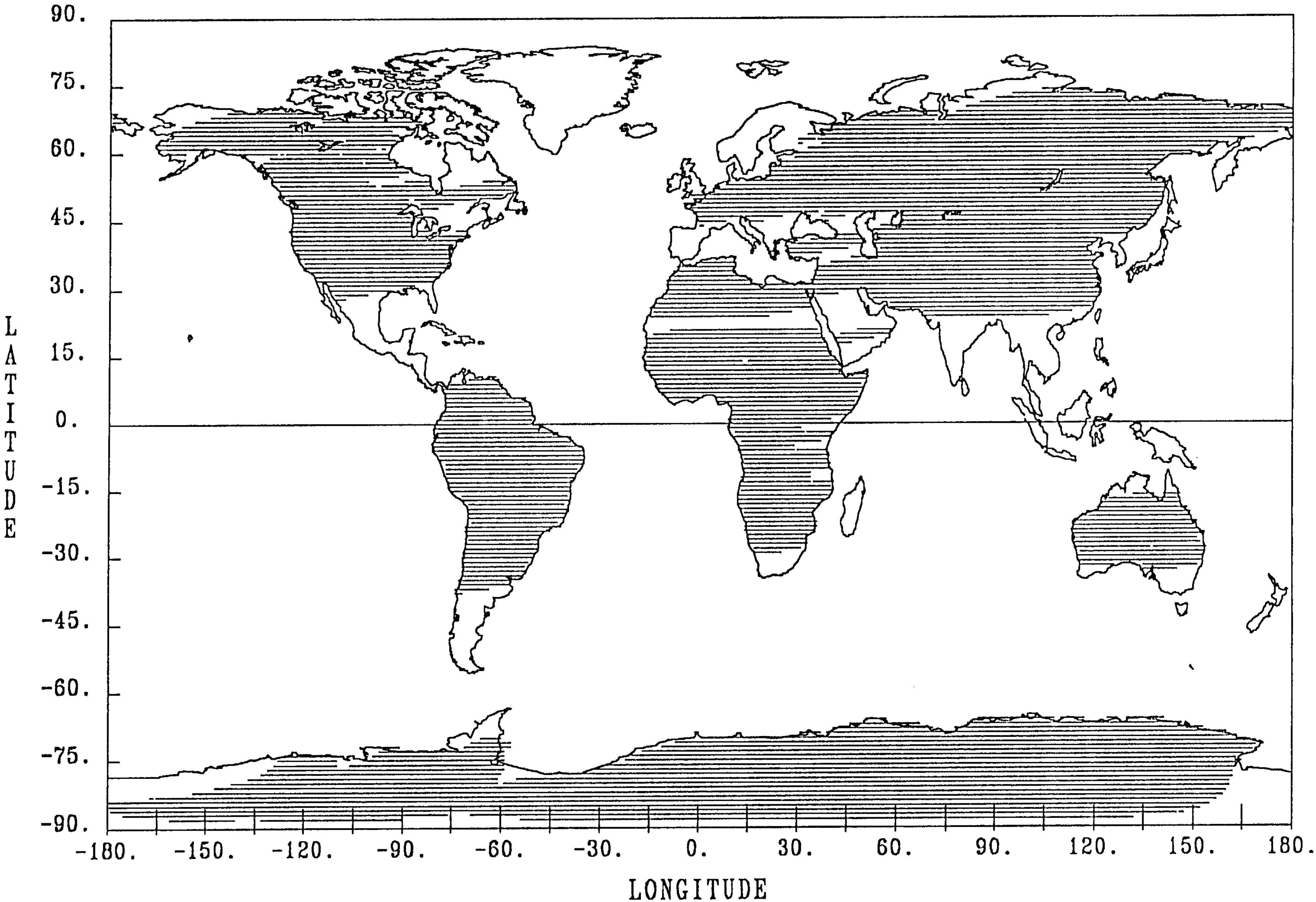
Altitude	705 km
Orbital Repeat Time	16 days (233 orbits)
Period	98.9 minutes
Inclination	98.25 degrees
Equatorial Crossing Time	1:30 local time

<u>MODIS-T Instrument Characteristics</u>

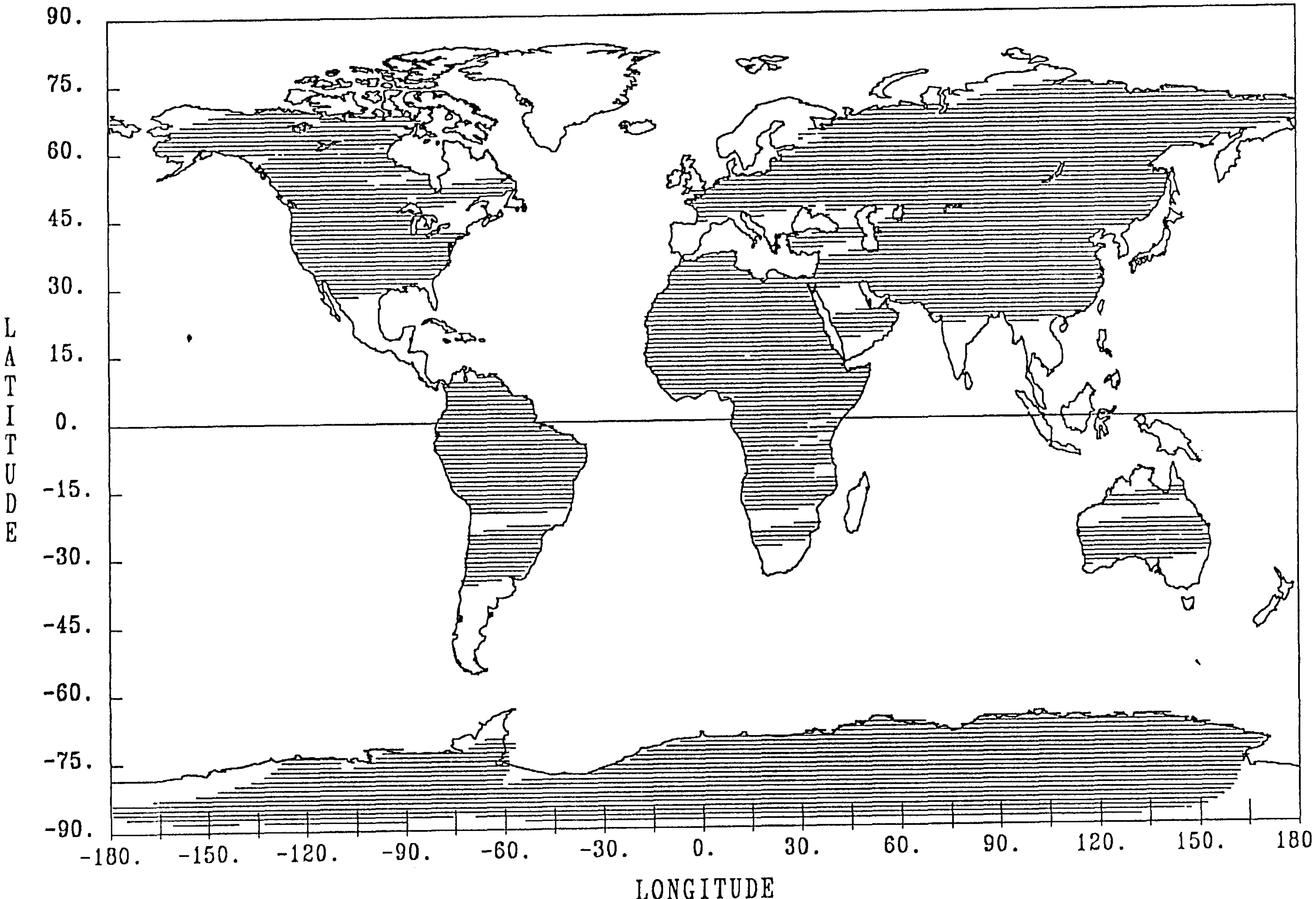
Scan Width	$\pm 45^{\circ}$
IFOV	1.56 mrad (0.089°)
Ground IFOV at nadir	1.1 km
Scan time	4.75 secs
Pixels Along Scan	1007
Ground Coverage Along Scan	1500 km (at nadir; no tilt)
Tilt	$\pm 50^{\circ}$
Pixels Along Track	30 pixels
Ground Coverage Along Track	32.6 km (at nadir; no tilt)
Successive Orbit Equatorial Crossing Longitude	-24.721°


LAND COVERAGE -- EQUINOX
90.
75.
60.
45.
30.
15.
0.
-15.
-30.
-45.
-60.
-75.
-90.
-180.
-150.
-120.
-90.
-60.
-30.
0.
30.
60.
90.
120.
150.
180.
LONGITUDE

LAND COVERAGE -- NH SUMMER

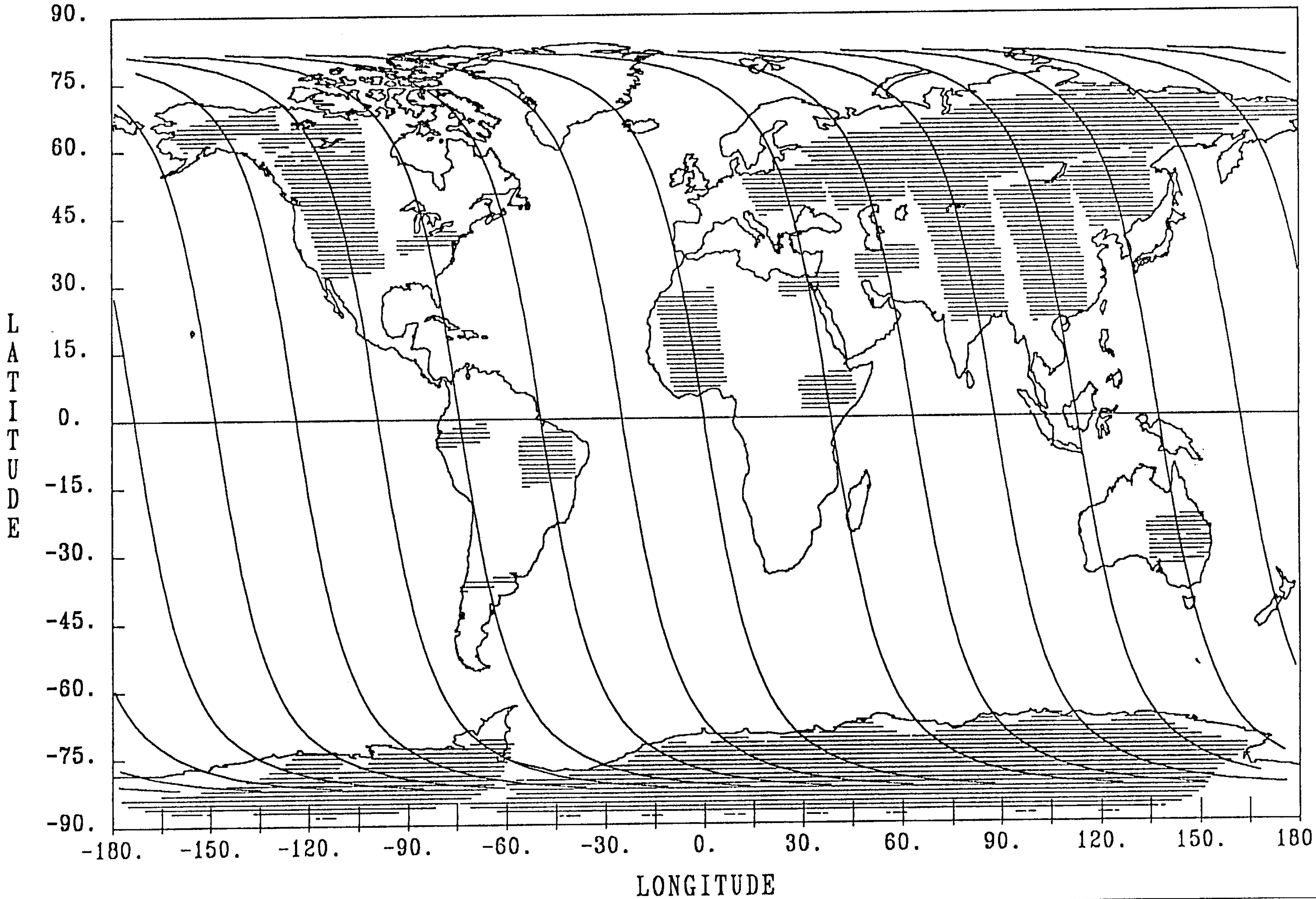


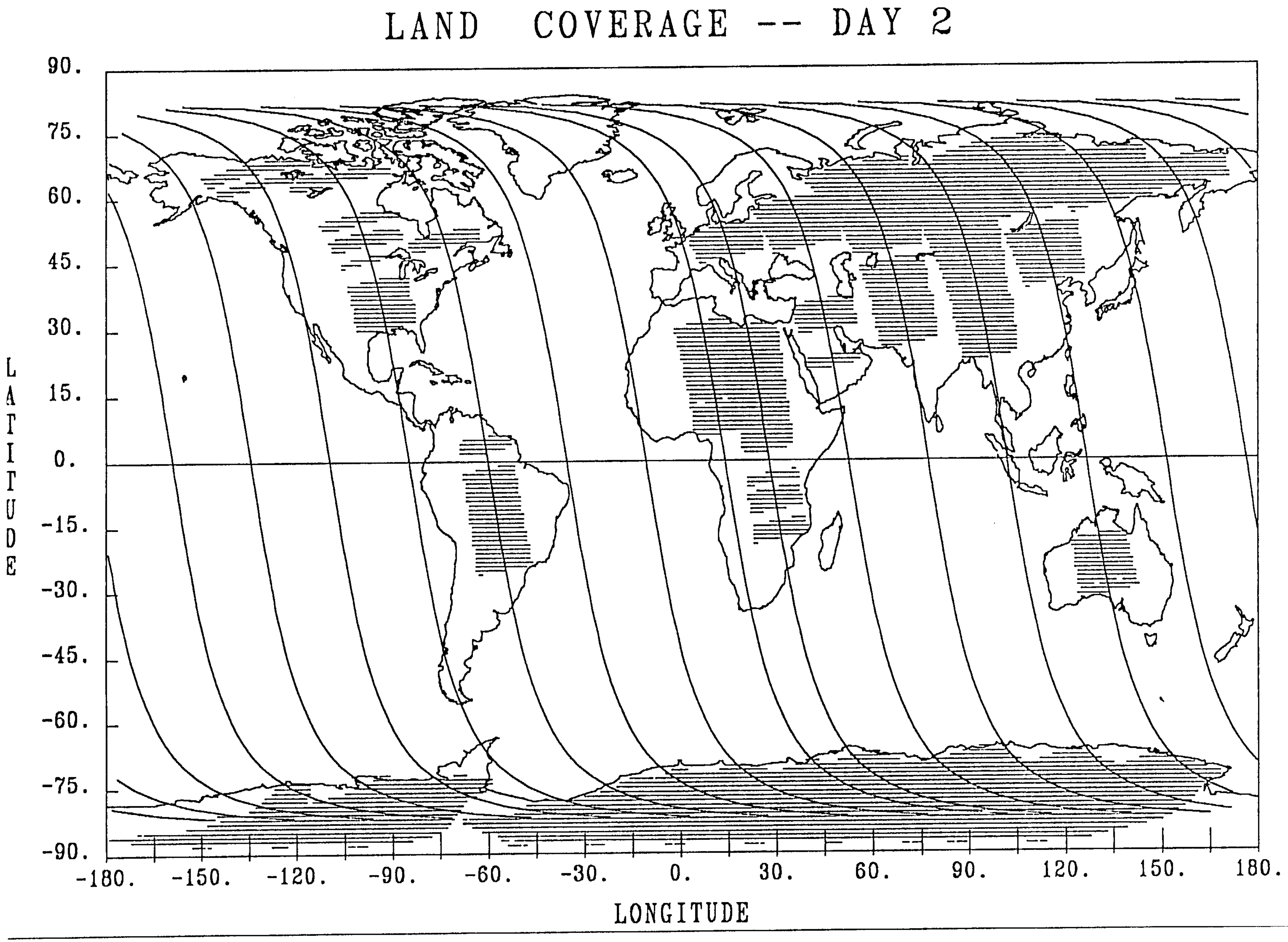
LAND COVERAGE -- NH WINTER

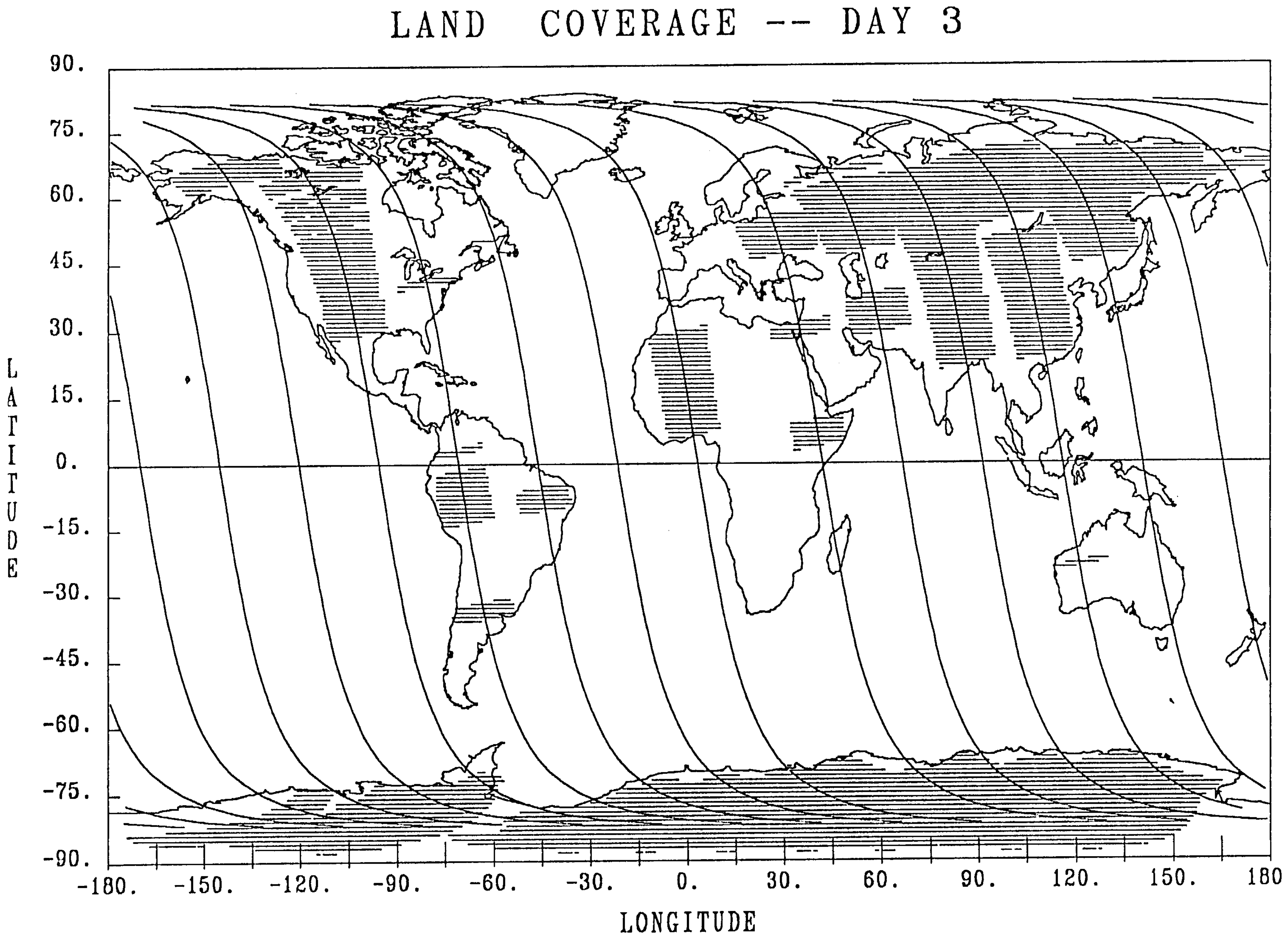


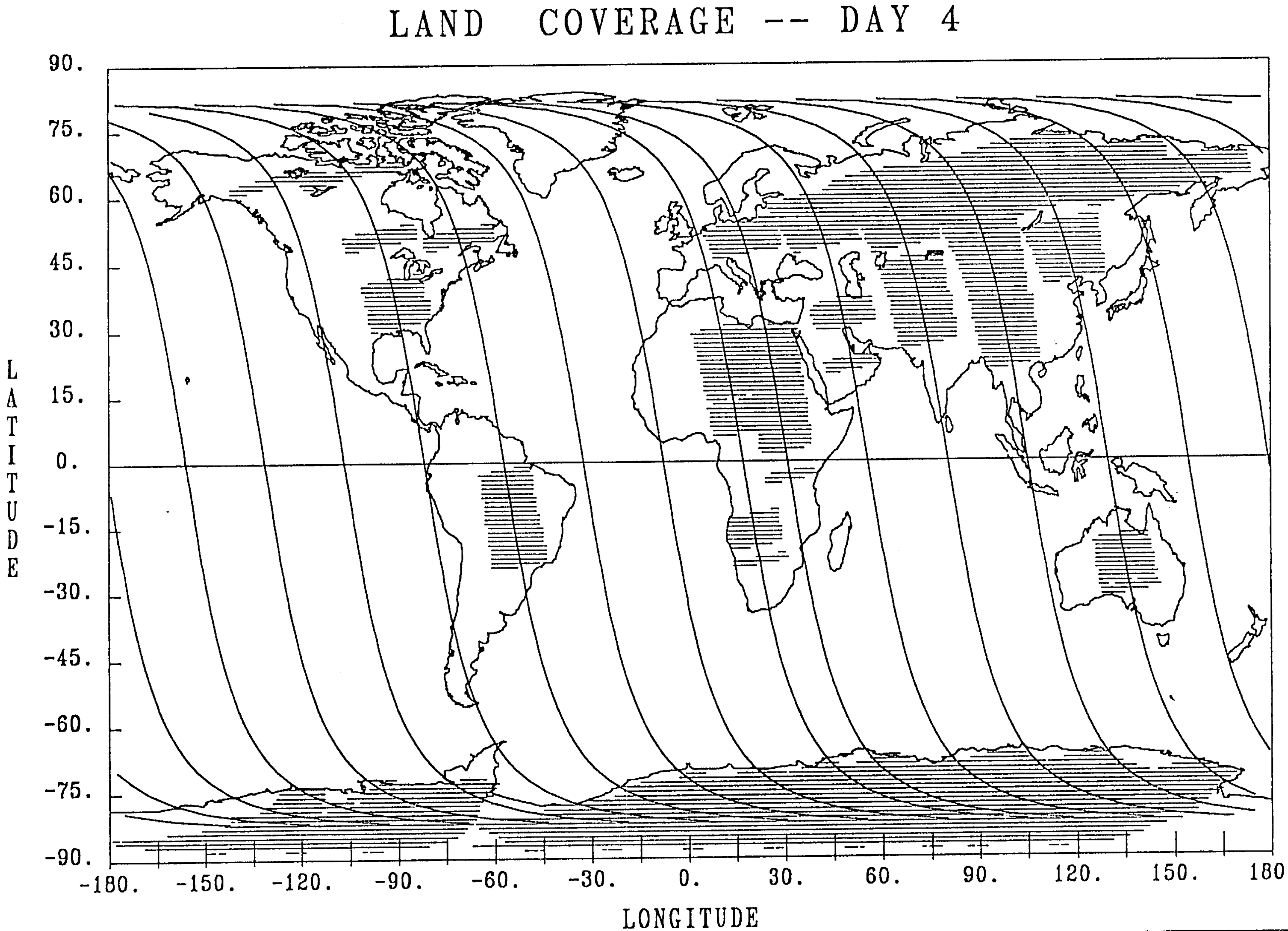
C&CS Tilt

LAND COVERAGE -- DAY 1

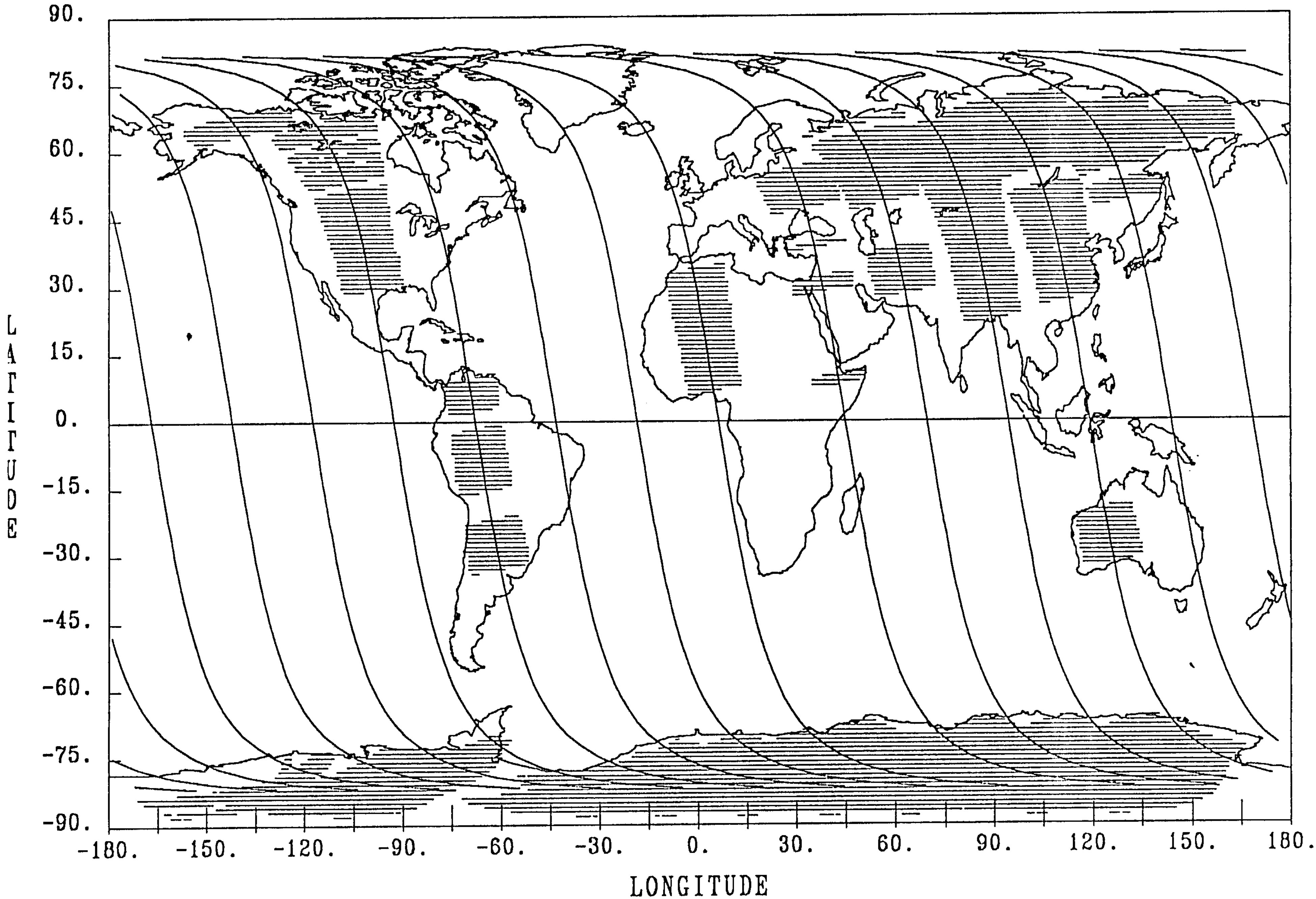



LAND COVERAGE -- DAY 2
LATITUDE
90.
75.
60.
45.
30.
15.
0.
-15.
-30.
-45.
-60.
-75.
-90.
-180.
-150.
-120.
-90.
-60.
-30.
0.
30.
60.
90.
120.
150.
180.
LONGITUDE

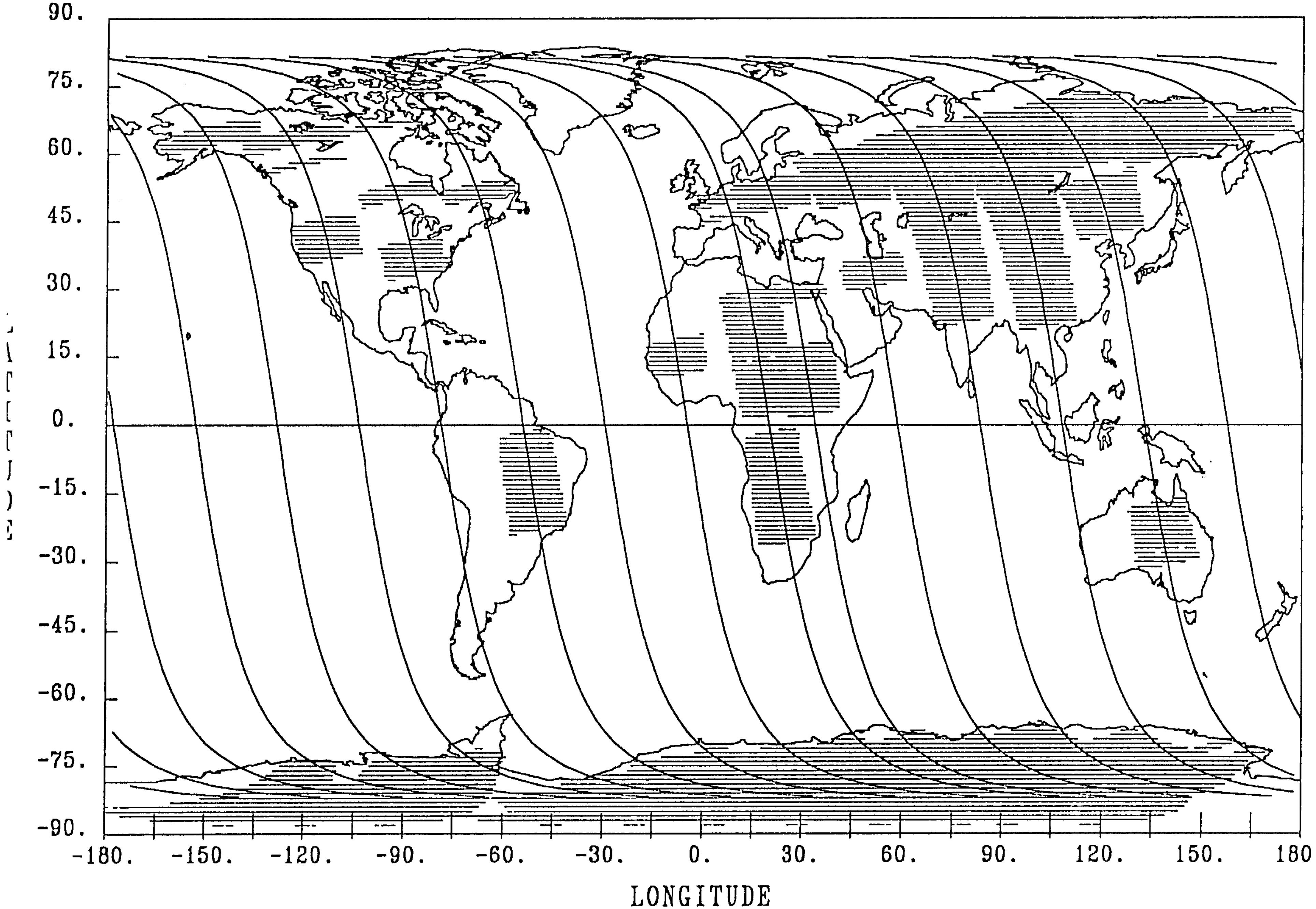

LAND COVERAGE -- DAY 3
LATITUDE
90.
75.
60.
45.
30.
15.
0.
-15.
-30.
-45.
-60.
-75.
-90.
-180.
-150.
-120.
-90.
-60.
-30.
0.
30.
60.
90.
120.
150.
180.
LONGITUDE


LAND COVERAGE -- DAY 4
90.
75.
60.
45.
30.
15.
0.
-15.
-30.
-45.
-60.
-75.
-90.
LATITUDE
-180.
-150.
-120.
-90.
-60.
-30.
0.
30.
60.
90.
120.
150.
180.
LONGITUDE

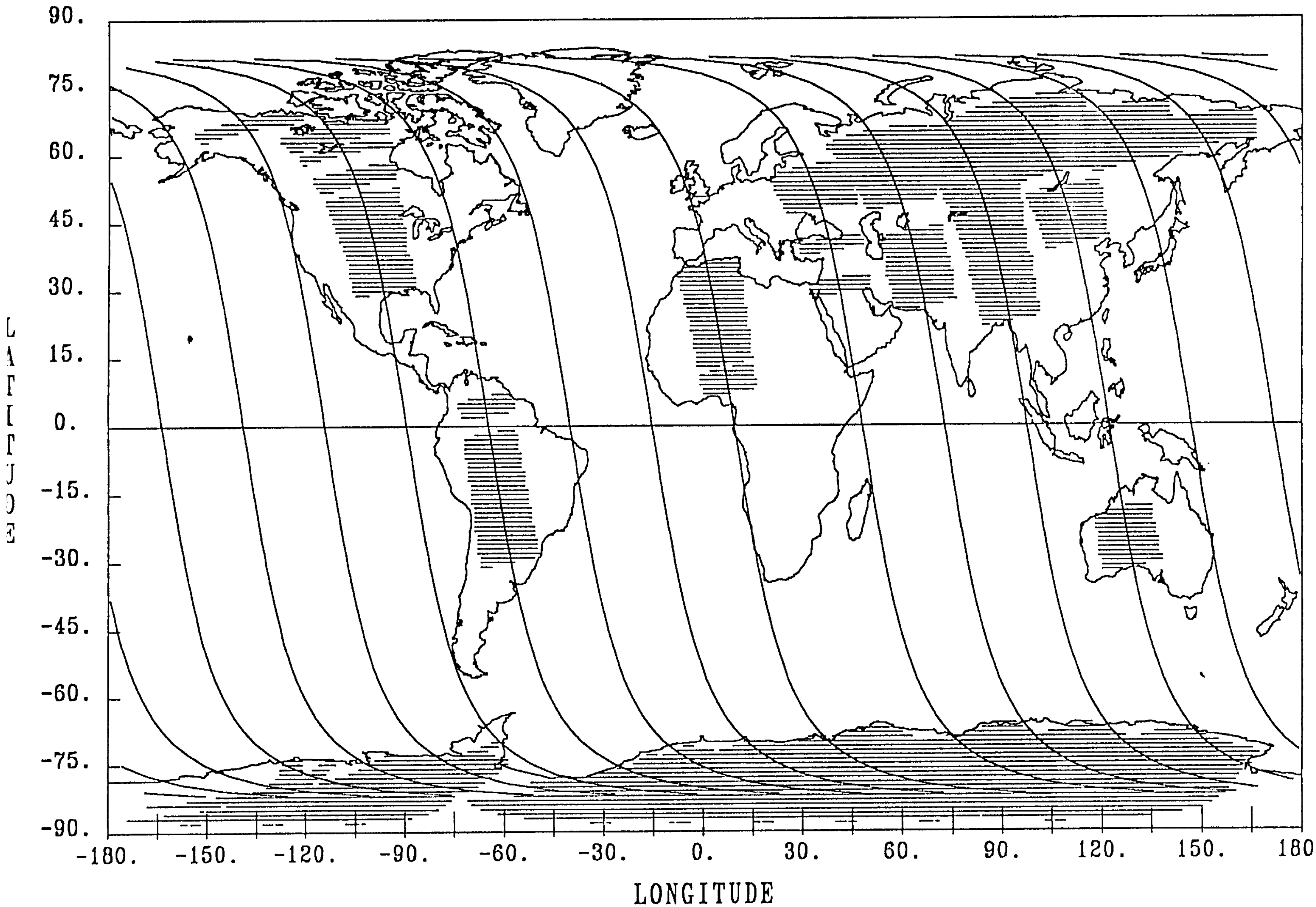
LAND COVERAGE -- DAY 5



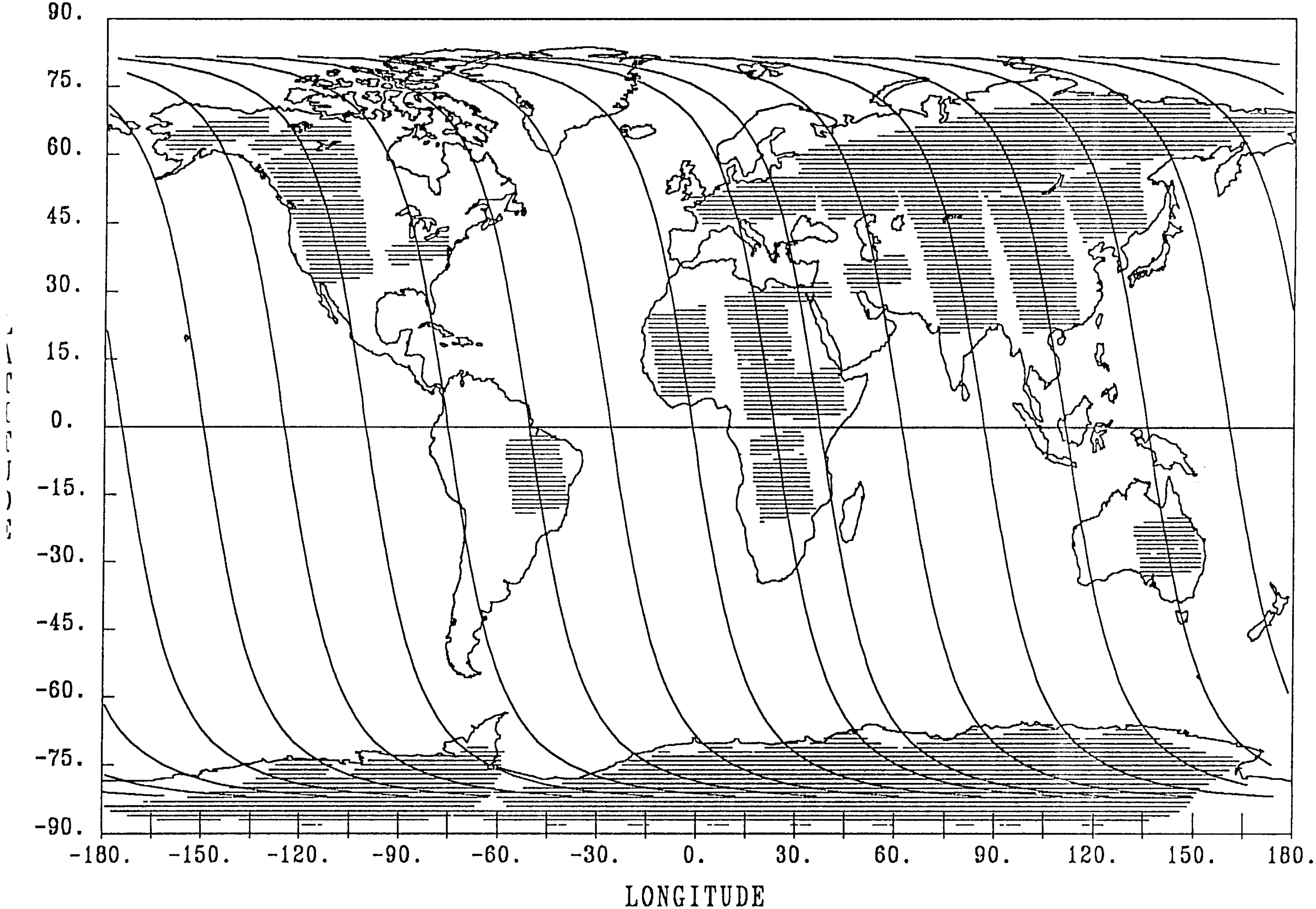
LAND COVERAGE -- DAY 6

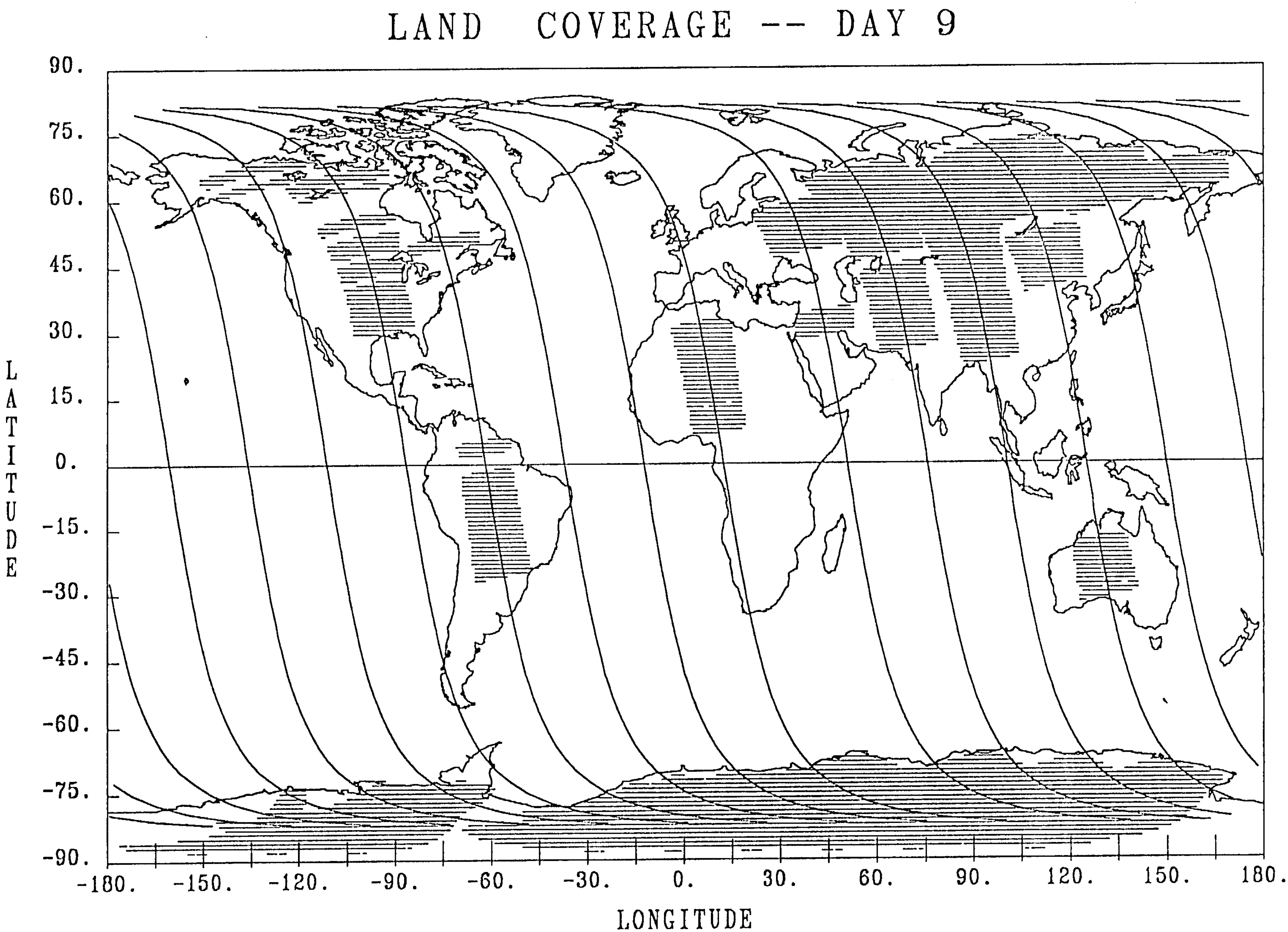


LAND COVERAGE -- DAY 7

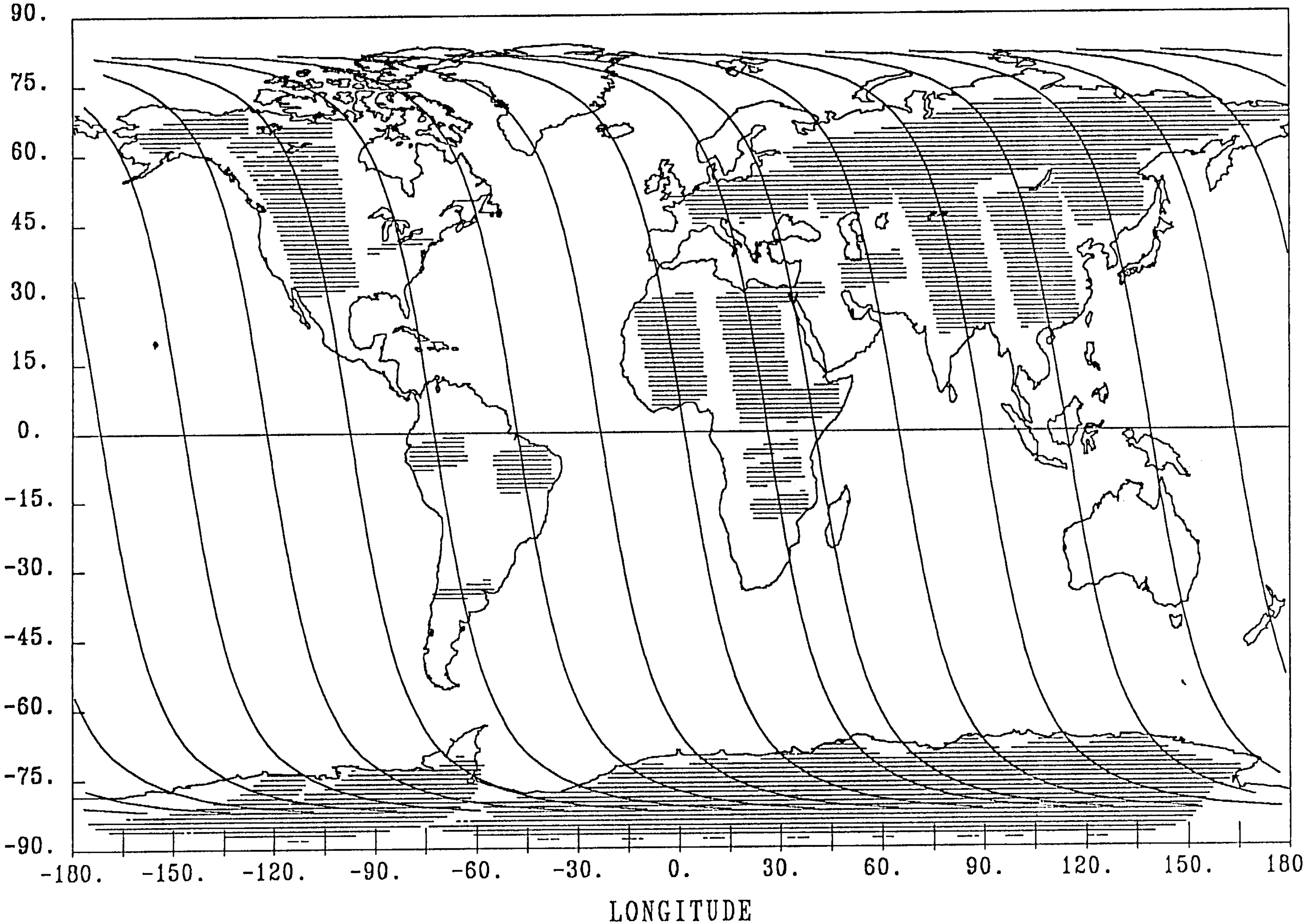


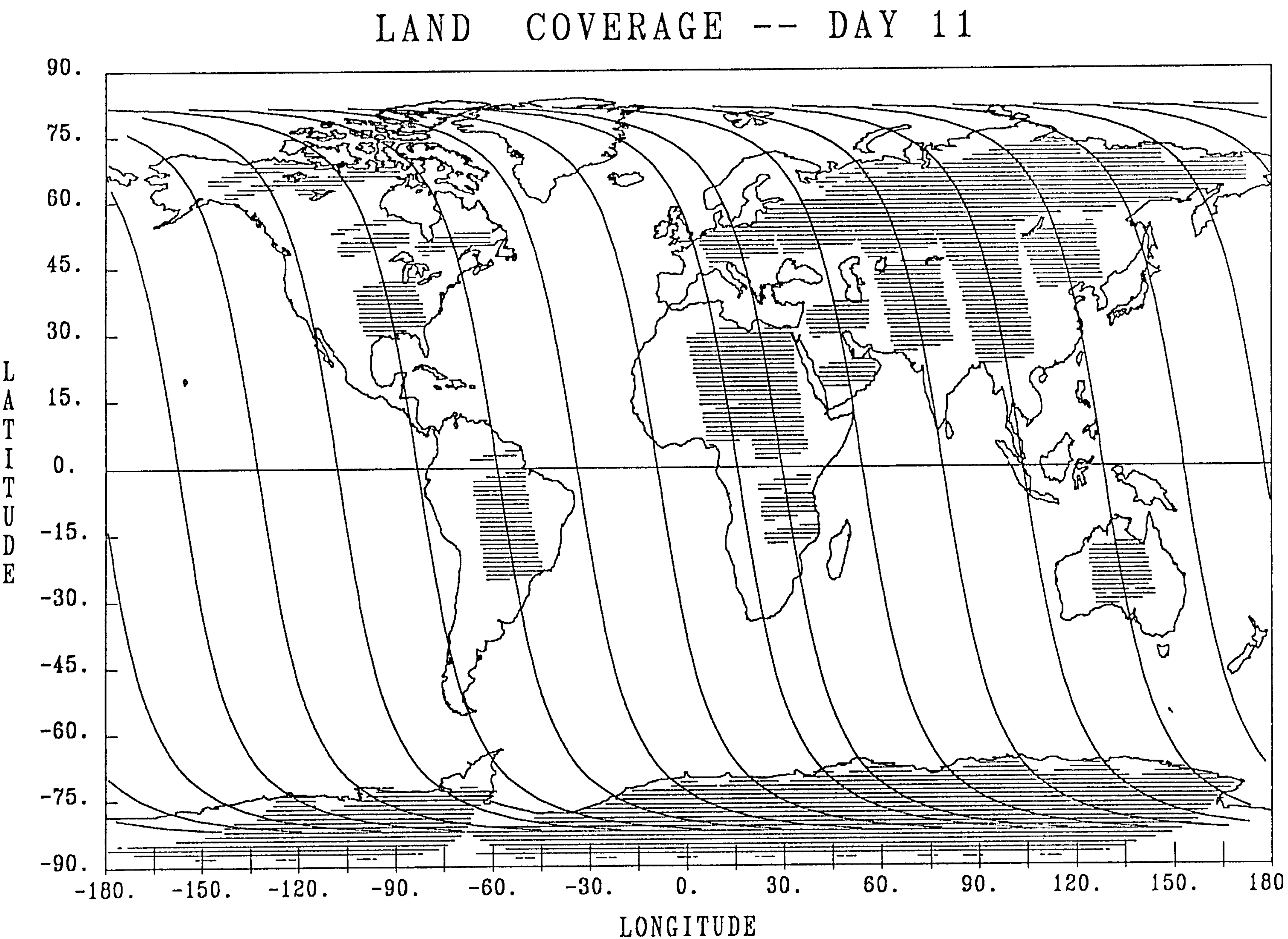
LAND COVERAGE -- DAY 8



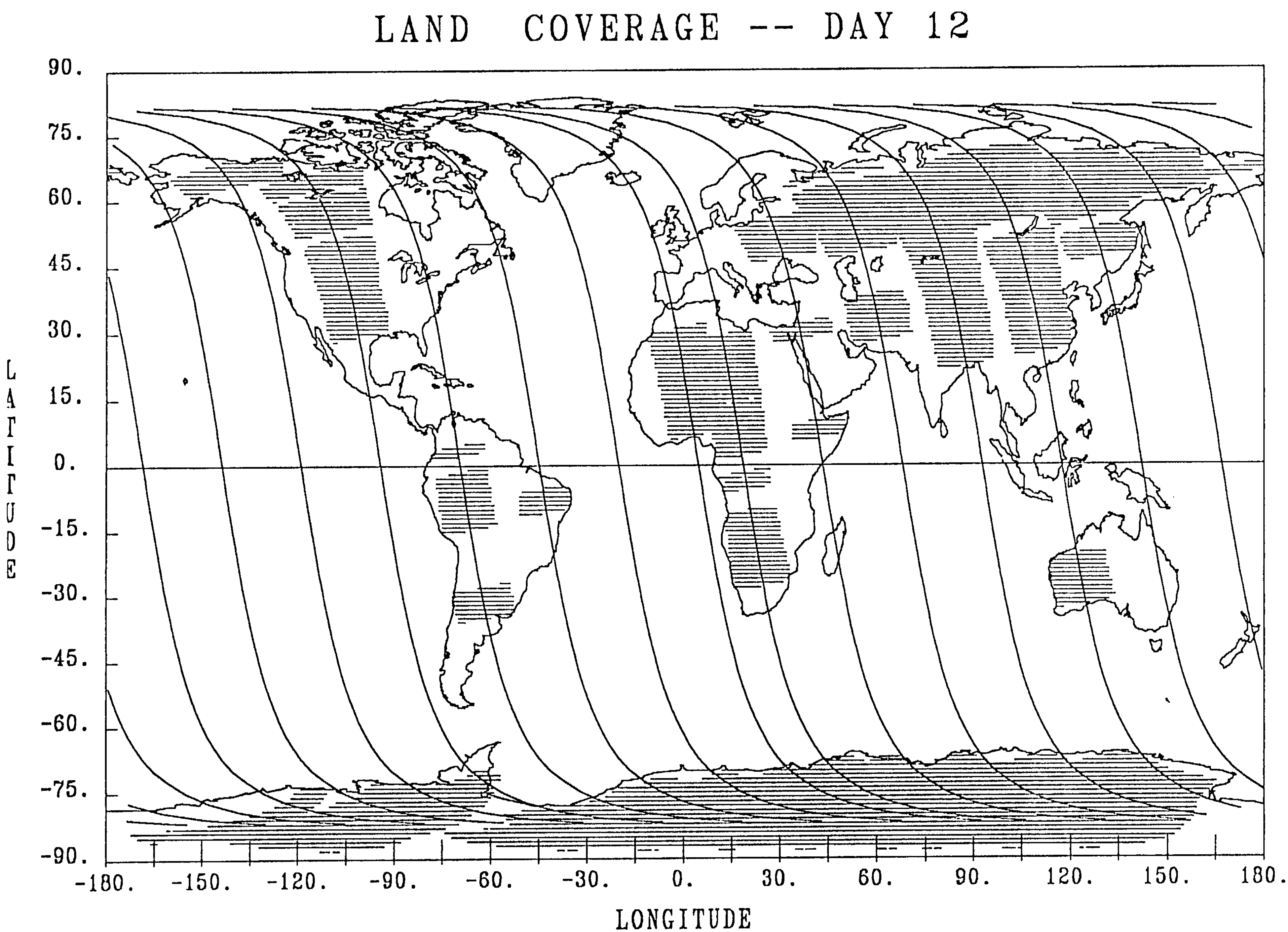

LAND COVERAGE -- DAY 9
LATITUDE
90.
75.
60.
45.
30.
15.
0.
-15.
-30.
-45.
-60.
-75.
-90.
-180.
-150.
-120.
-90.
-60.
-30.
0.
30.
60.
90.
120.
150.
180.
LONGITUDE

LAND COVERAGE -- DAY 10

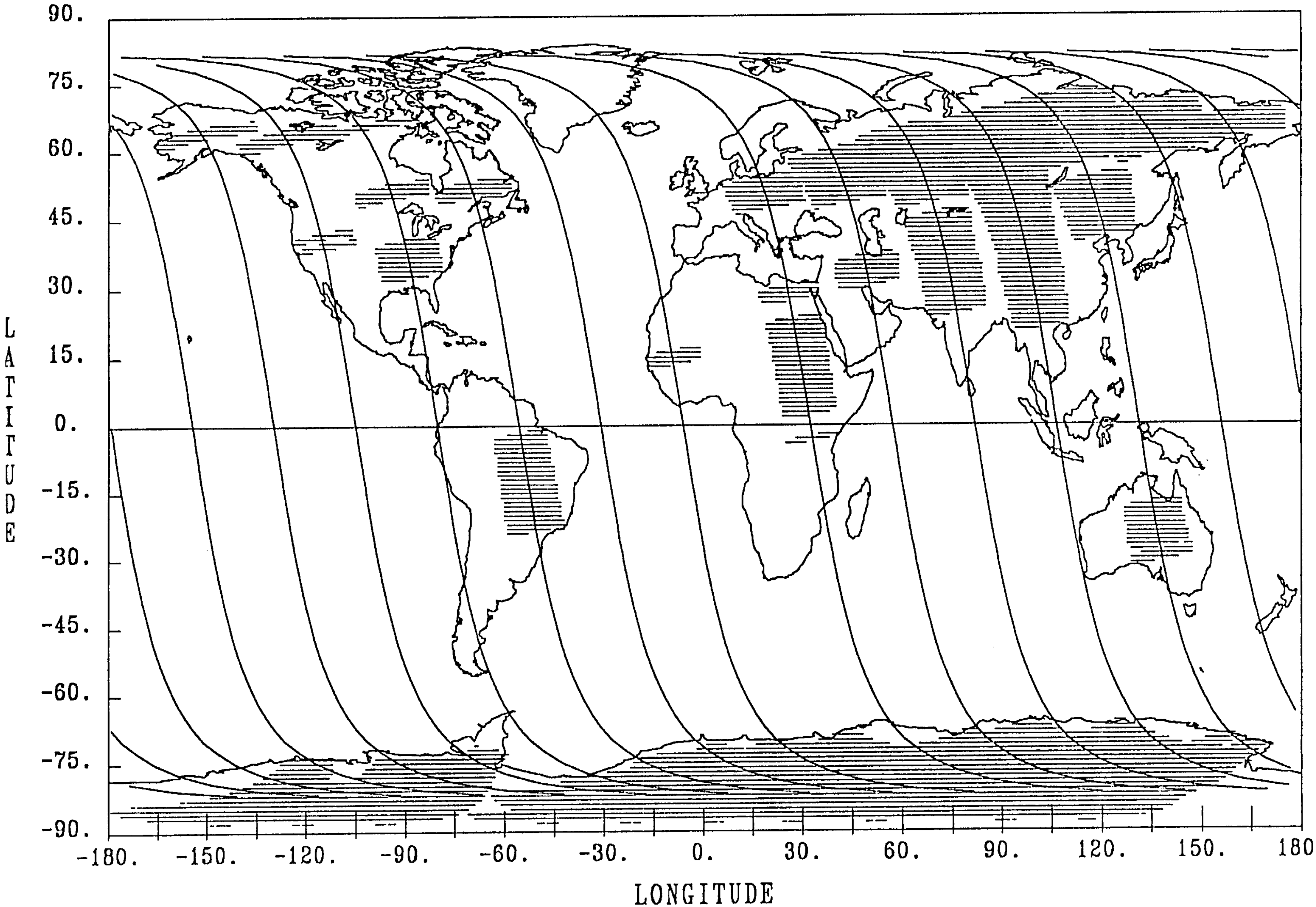




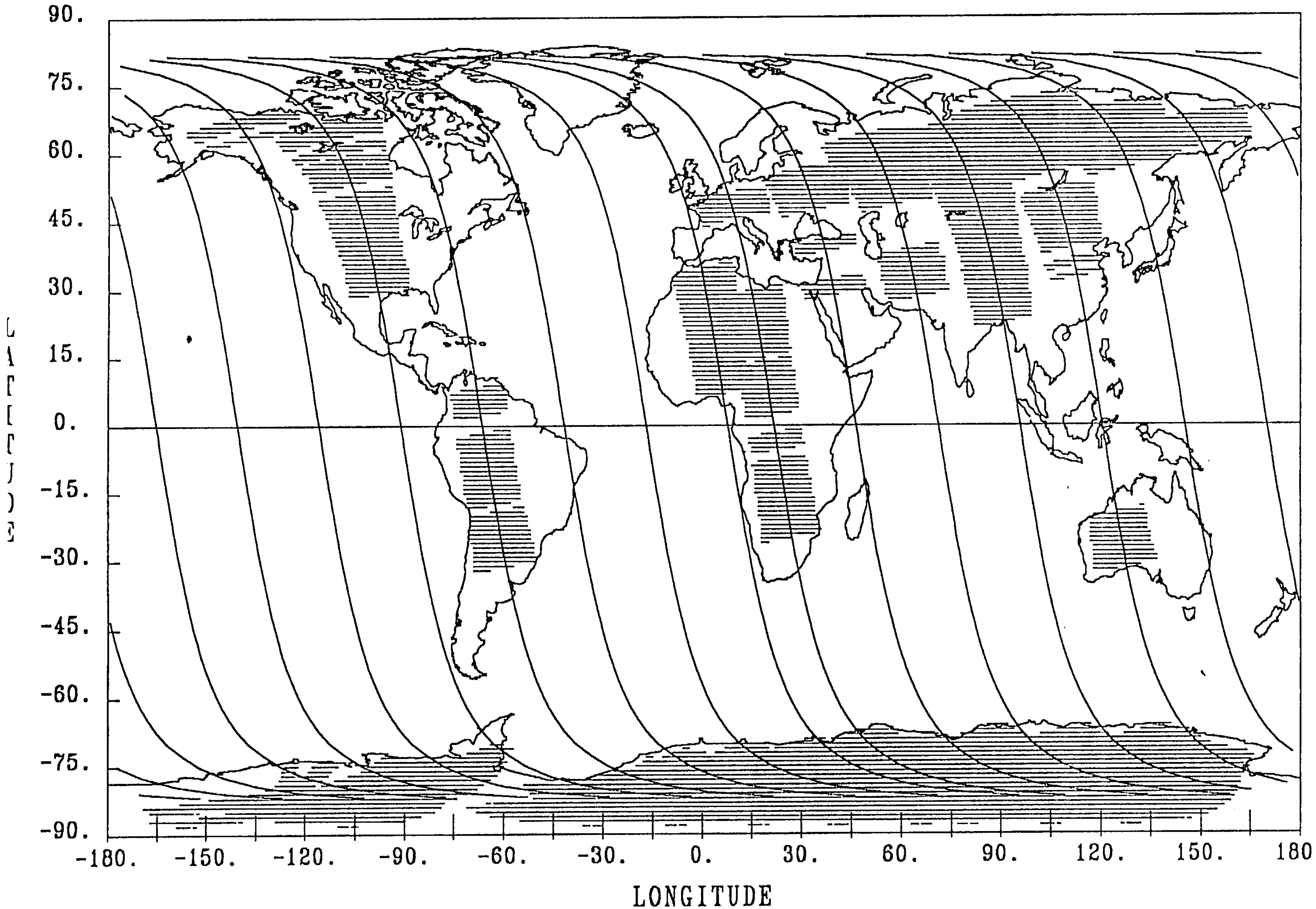
LAND COVERAGE -- DAY 11
90.
75.
60.
45.
30.
15.
0.
-15.
-30.
-45.
-60.
-75.
-90.
LATITUDE
-180.
-150.
-120.
-90.
-60.
-30.
0.
30.
60.
90.
120.
150.
180.
LONGITUDE


LAND COVERAGE -- DAY 12
90.
75.
60.
45.
30.
15.
0.
-15.
-30.
-45.
-60.
-75.
-90.
LATITUDE
-180.
-150.
-120.
-90.
-60.
-30.
0.
30.
60.
90.
120.
150.
180.
LONGITUDE

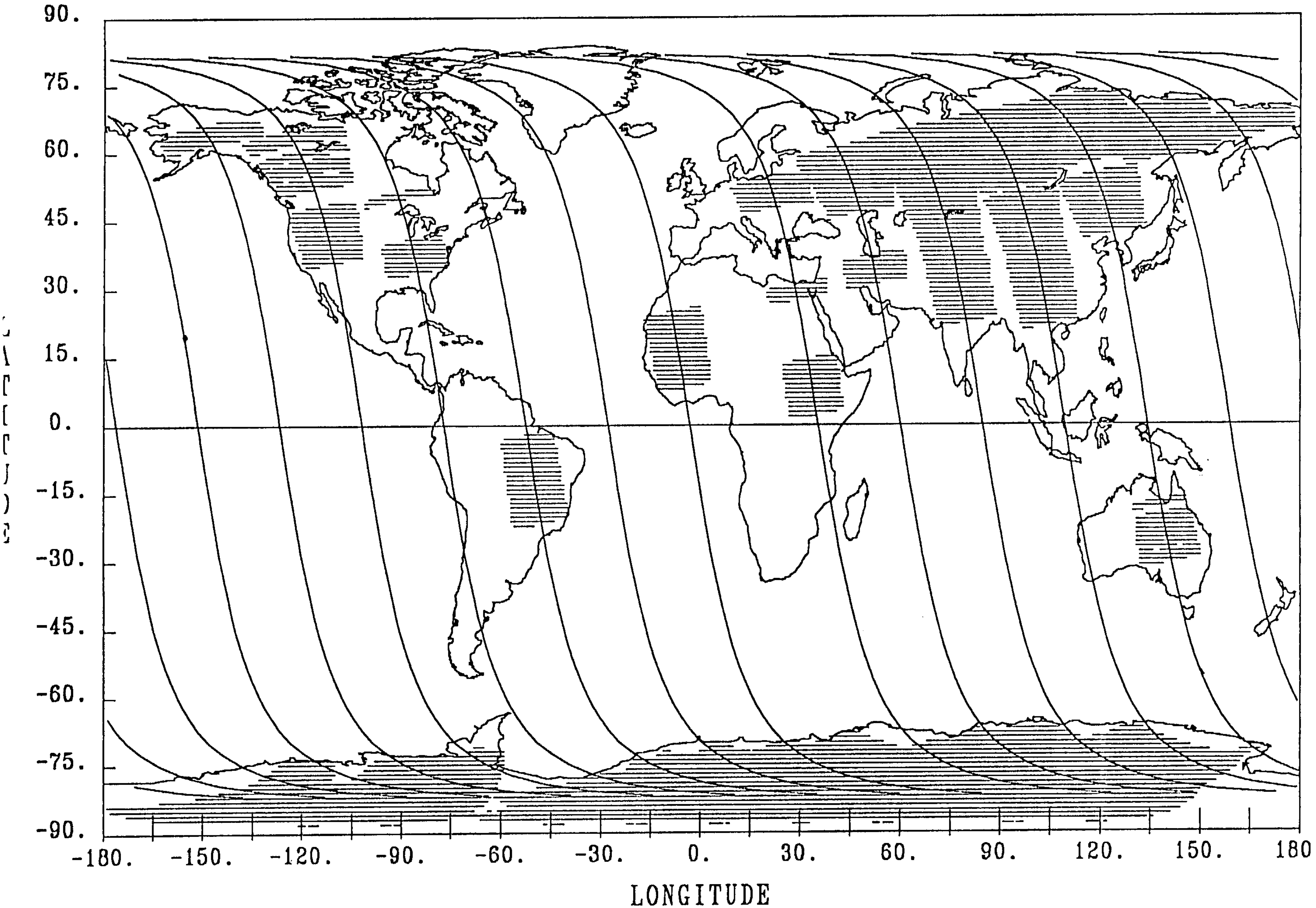
LAND COVERAGE -- DAY 13



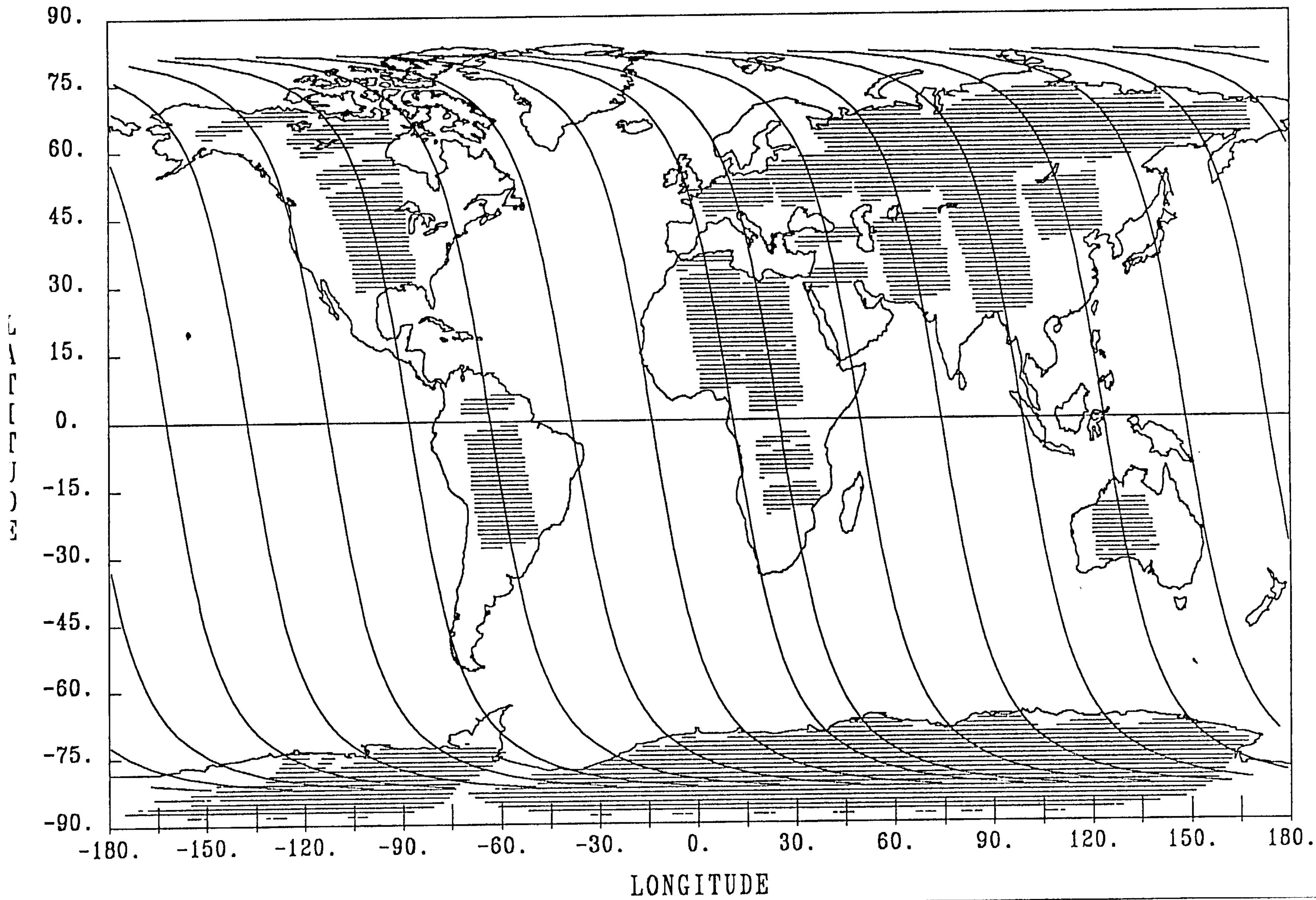
LAND COVERAGE -- DAY 14



LAND COVERAGE -- DAY 15



LAND COVERAGE -- DAY 16



Level-3 Processing Sizing Estimates

The following presentation is a general outline which gives the lower and upper bounds for the sizing of Level-3 processing. A final sizing estimate for each Level-3 product will be determined by its specific algorithm. Level-3 processing may be done by updating a weighted mean value on the fly. The Level-3 product is then easily calculated after all the Level-2 data has been processed.

The general lay-out of the different steps in the Level-3 processing and a rough sizing thereof is discussed under the assumptions that:

- The 1 km IFOV Level-2 products are considered to be input. Regional output scales are on 1, 5, 10 and 20 km meshes. Global output scales are on 20, 50, 100 km, 1°, 2.5° and 5° meshes;

- Earth-located gridded data values are kept in a global array. The indices (i,j) of each array element refer to latitude and longitude positions of the data on the globe;

- Each Level-2 datum could undergo Level-3 processing "on the fly," which means as the data comes in;

- The data compositing on Level-3 is assumed to be done by generating a weighted average of the data points in the global array. For this we need to keep track of two sums, e.g. the sum of the weights and the sum of the weighted data. For QC purposes we may need to keep track of the sum of the weighted squared data, etc., at each global array location. This can be done on the fly and is therefore computationally very efficient. The weighted products are updated every orbit. The different steps in the Level-3 processing are:

1) <u>For each Level-2 datum</u>:

1. Calculate the position of the datum in the global array:10ops.

2. Read the data from the global array: 2 to 7 ops.

3. Calculate the weight for the new datum. The number of operations depends on the kind of product: 2 to 100 ops.

4. Update the sums: 2 to 20 ops.

5. Overwrite the data in the global array: 2 to 7 ops.

2) <u>At the end of an accumulation period, for each Level-3 product</u>:

1. Go through global array and compute new Level-3 data: 3 to 40 ops.

2. Write out the Level-3 product: 2 to 7 ops.

In total we arrive at:

18 to 144 ops per Level-2 datum and per Level-3 product.

Metadata and Browse Data: Definitions from the IWG

Metadata is information that describes data. As applied in the Remote Sensing Environment, metadata normally includes the following four elements:

a. A high-level directory.

This metadata component provides a short and concise description of the major features of available data viewed from the user perspective. This directory stands in roughly the same relationship to the contents of a data storage facility as the table of contents of a book stands in relationship to the contents of the book.

b. Unstructured descriptive information.

This component contains narrative or other descriptive information relating to data contents or attributes that does not otherwise fit into the formal structure of the data storage facility.

c. A data granule inventory.

A data granule is the smallest information item manipulated within the data access system. The inventory relates each granule of data within the system to a set of attributes that apply to the granule. This is the formally structured portion of the metadata; it is the key to selective retrieval of data based on formally-specified data attributes.

d. Browse data.

Browse data is information that a data user may require to complete the selection of data appropriate for his objectives. Besides the formal data attributes included in the data inventory (item c.), the data user may require information discernable only on direct examination of appropriate visual images. The browse component of metadata provides the visual information that may be required to complete the data selection process.

Two types of browse data can be defined:

<u>Standard browse data</u>. Standard browse data is routinely generated along with the products to which it applies. It is intended to serve the needs of a general data user who requires visual information in addition to the data attributes cataloged in the data inventory.

<u>Extended browse data</u>. Extended browse data is information not of general or widespread interest but peculiar to the interests of a specific user needing a product of particular or unique interest to his investigation. Since the specialized interests of all investigators cannot be predicted in advance, extended browse data

is not routinely generated as products are produced. Extended browse data is generated by a processing system after the receipt of a user request and it requires the real-time availability of an appropriate processing system to provide interactive user response. The simplest type of extended browse data would be a sample image from a requested data set. Extended browse data is distinguished from the full data set by a reduction in data volume and the use of data transmission techniques appropriate for small volumes of data but perhaps unusable for an entire data set. Because of the extroardinary volume of MODIS data products, some types of extended browse data may be impossible to produce within reasonable time constraints. The UARS data system does not provide extended browse data.

What are the implications for MODIS data? Discussion.

EOS Science Advisory Panel for Eos Data and Information

This report is a summary of the EOS Data Panel's recommendations as presented during the March 1990 IWG meeting.

The current status for Phase B and the follow-on Phase C/D activities were presented (* represent changes as of 21 March 1990):

- April 1990: Completion of Phase B reports
- May 1990 Draft "Requirements Specifications" issued by EOS project, reviewed by EOSDIS advisory panel.
- September 1990: Draft "Phase C/D" (Design and implementation) Request for Proposal released, reviewed by Advisory panel and scientific community.
- *February 1991: Official version of Phase C/D RFP released. Contractors have 60 days to respond.
- *January 1992: Winner selected, under contract by May 1992.

EOSDIS is recognized as crucial to the success of EOS. Presently, the use of satellite data is hampered by the requirement that users understand the details of the instrument, surface electromagnetic properties, and by data costs and access difficulties. The lack of adequate techniques and algorithms for estimating geophysical and biological variables also limits satellite data use. To be successful EOSDIS must transcend these difficulties.

EOSDIS will be judged by how well it supplies reliable and significant data products, and how it promotes interaction with these products. These ultimately will show up as results and creative ideas in EOS scientists' publications. Communities to be satisfied by these products are EOS investigators, other researchers, the Global Change community, congress, other agencies, and the lay public.

EOSDIS must function to encourage multidisciplinary and interdisciplinary domestic and international research. EOSDIS information will combine data from other sources (agencies, nations satellites, aircraft, in situ, operational and research data). EOSDIS is distinguished from other remote sensing systems by its commitment to provide a suite of useable scientific information -- guaranteed availability within an agreed upon time period (with no proprietary period). To the extent possible, this also applies to non-EOS data. It is recognized that some data archives have not yet entered the 20th century. EOSDIS contractors will have to organize these data.

EOSDIS system architecture should be independent of hardware, distributed, and optimized for software portability and flexibility, not efficiency. UNIX POSIX standards were advanced as meeting this requirement.

Software coding standards must be used. The software should work the first time and give proper answers (not just compile and give reasonable answers). It has to be documented so other programmers and scientists can understand it. If a modification is required a person other than originating programmer should change the software. If they can not understand the program -- rewrite it. This will prevent problems downstream.

Non-EOS data is required for many EOS investigations. It is difficult to provide access because they come in a variety of formats, are not easily accessible by networks (in some cases the original archive has little incentive to provide these data).

EOSDIS contractors are focused on EOS instruments and do not understand acquiring and translating non-EOS data. EOSDIS must identify these data sets, establish MOUs and provide tools and assistance for translating these data.

The Science Advisory Panel for EOS Data and Information recommendations were:

- Use existing data sets to process data into scientific products. This will develop scenarios for Eos data products.

- Selected user facilities should take advantage of existing and anticipated scientific expertise. Put the scientific programming at facilities which have the knowledge.

- For data distribution to scientist, experiment with high-bandwidth communications and other media.

- Develop realistic expectations for rapid browsing and visualization of large data sets.

- EOS IWG scientists must take part in developing and reviewing standards and procedures for coding, operating systems, product definition, formats, units, and coordinate systems. They must participate in peer review processes and comply with the consensus once reached.

IMPRESSIONS DERIVED FROM THE EOS FACILITY INSTRUMENTS PANEL MEETING

MARCH 19, 1990

7:00 TO 10:00 PM

I. Discussion of the Facility Instrument Data Product Table

The meeting spent considerable time discussing the concept of uniqueness in data products. In many cases (e.g., cloud coverage or fractional area), there appears at first glance to be considerable redundancy. However, the different instruments observe the Earth on substantially different spatial, vertical, and temporal scales. As such, every data product is "unique." There are also data products which are spectrally unique, such as cloud optical thickness which depends on the wavelength of the observation. There was some thought that the table should be backed up with text. The text would provide the investigators with the opportunity to elaborate on the unique elements of the data products themselves. Another type of uniqueness is the observing platform. As such, GLRS would take measurements unique relative to any instrument on the first platform.

There were minor revisions to the data products listed on the table. In terms of the title of the data product, the measurement units and the resolution. The ALT Group added a new product, "Total Column Electron Content". The HIRIS Team provided two pages of revised/new data products in table form. The AIRS Science Team will be meeting March 20 and will review the data product table as part of that meeting. It was generally felt that the data product name should be listed only once, with consistent units for all observations of that product, and then the various instruments and their appropriate data products could follow the product name. It should be expected that the panel, and the facility instrument teams, will be able to iteratively scrub the table now that all of the information has been compiled. Types of filters the teams might apply include "which products are unique?", and "which products are impossible?" It was noted that the ITIR data products are not fully developed since the team is only now be creating. In addition, the ALT instrument does not have a formal science team, but is instead extending the concept of TOPEX/POSEIDON.

It was suggested that the table differentiate between measurements and the subsequent data products taken by survey instruments (e.g., GLRS and HIRIS, capable of only observing a small portion of the Earth daily) and observatory instruments (e.g., MODIS and AIRS, capable of taking global observations daily).

The concept of uniqueness was compared for PI and facility instruments. A PI instrument takes unique observations for typically a single (or small number of) data products. A facility instrument is capable of taking observations defining many derived data products. The uniqueness of the facility instruments capabilities lies with the instrument (and includes the observing spatial, temporal, and spectral scales). For example: MODIS-global coverage; HIRIS-high spatial resolution; AIRS-high vertical/spectral resolution; etc.

The interdisciplinary and PI instrument requirements are only now being received by the facility teams. It would be helpful for the teams to have customized printouts from the IDS product requirement data base, and the PI data base if possible, defining the requirements on the facility instruments for data products.

II. Approach

MODIS has an approach whereby the data team is divided into three disciplines: ocean, land, and atmosphere. While the land and atmosphere disciplines are composed of investigators developing independent yet coordinated proposals, the ocean discipline is putting together a set of individual proposals which are highly coordinated and designed to intermesh over the discipline. The coordinated effort will show how the proposals as a group fit into the 13-step submittal plan outlined by Al Fleig at the last MODIS Science Team Meeting. The costs for the ocean discipline will be coordinated as well.

HIRIS has a Science Team composed of 14 team members, each with algorithm responsibilities. The team leader is responsible for verifying that the algorithms work. He will do this in stages, differentiating algorithms available now versus those that will take longer to develop. For the latter, a data collection plan will be developed. A peer review group will be brought together to review and sign off on algorithm concepts when the investigator feels the algorithm is sufficiently mature and ready to publish. A second group, perhaps at JPL, will then harden the code for implementation once the peer review approves the algorithm.

The ALT Group is necessarily following a quite different approach. At present here is no fully committed Science Team, instead the TOPEX/POSEIDON Team acting in an advisory role. There is no detailed data product plan at present, except that of following the TOPEX model for algorithms and data processing. Because no letters from Len Fisk have been received, no proposals are being written. However, ALT is a mature instrument, that will continue the TOPEX measurement concept into the long-term.

The GLRS Team is under less pressure to develop proposals as these are not due for 18 months (GLRS will fly on EOS-B with a later launch date). There are organized working groups presently involved in algorithm development.

The SAR Team is also working with an 18-month delay. The team is making sure that their supplied products match the interdisciplinary investigational requirements.

The AIRS Team is requiring 2-page writeups including flow charts, inputs, outputs, and approach for each data product. At the March 20 Team Meeting, the data product capabilities of AIRS will be reviewed by the team members in the form of presentations. The results will come out as published minutes. The AIRS Team believed that in certain cases parallel research efforts will be required and will justify these parallel efforts. For example, an accurate yet demanding physical retrieval of atmospheric profiles versus a fast approximate matrix inversion. In October 1991 the AIRS Team will deliver simulated data sets to investigators proposing identical products. Six months later, the accuracy of the retrieved products from the competing techniques will be compared; algorithm complexity and computational requirements will also be considered in the comparison.

The ITIR Team requires some clarification of the team concept off-line. The team is being composed of the original TIGER team plus a new Japanese element. A meeting at JPL will take place next week, as will a meeting with the Project this week.

The LAWS Team is operating with a 1-year delay because of the planned accommodation on the Japanese platform. The team is trying to refine its definition of data products. A new round of simulation studies is beginning; these simulations are critical for LAWS as there are no similar precursor measurements as is the case for MODIS, AIRS, and the other facility instruments. The LAWS Team would like to set up an off-line algorithm end-to-end test facility developing products from Level-0 to Level-2 (at least) using simulated data.

The AMSR Team has no leader at the moment. For proposal purposes, investigators are being asked to treat AMSR as if it is HIMS.

III. Problems

The MODIS team is concerned about the potential for data packet loss in the end-to-end platform to EOSDIS data system. A definitive, or least quantitative, statement from the project would be helpful. With a bit error rate of 10**8, a comparable packet loss rate should also be about 10**8. The loss of even one packet in a million, though at first glance trivial, would be a hundred times worse. This problem is compounded by data retrieval algorithms that require multiple (up to 10) spectral bands.

The EOS data panel is concerned about timeliness requirements for data and may wish more stringent requirements on throughput through Level-1. For example, while 100% of the level processing might be completed in 48 hours after acquisition, perhaps 95% could be completed in 24 hours. The interdisciplinary requirements regarding timeliness (e.g., volcano eruption data from MODIS) need to be compiled.

The ALT Team has specific concerns regarding the repeat period of the platform (perhaps 16 days +/- 15 minutes). Ideally, a repeat period good to 1 or 2 km would be most useful. Furthermore, ALT may have some stringent pointing knowledge requirements.

The GLRS team would like to maximize the synergism between GLRS observations (primarily of clouds) on EOS-B and image data from EOS-A. To this end, collocation of the platforms to the maximum extent possible is requested. It was recognized that a separation of 10 to 20 minutes would be required for downlink of the data.

There was some discussion regarding the possible elevation of the orbital altitude from 705 to 824 km. Considerable concern was expressed regarding the revisions in instrument design that would result from such a change.

AIRS raised a question as to whether a power supply of 110 VDC should be retained. Although 200 to 300 pounds of copper wiring might be saved with the higher voltage, the instrument electronic requirements will likely negate the advantage.

The ITIR Group expressed some concern about attitude control as it bears on their capability to perform stereoscopic views.